APPARATUS AND METHODS FOR DESIGNING A PRODUCT USING A COMPUTER NETWORK

TECHNICAL FIELD

5   The preferred embodiment of the disclosed invention applies generally to apparatus and methods for designing tools, such as carbide rotary tools (CRT) and facilitating the ordering of such tools.

BACKGROUND OF THE INVENTION

10   Computer numerically controlled (CNC) machines are widely used in industry to manufacture components or parts from different types of materials. These machines typically include a rotary spindle mechanism having a tool holder at one end for holding a

15   rotary cutting tool during a machining operation. It often is desirable to create a custom rotary tool for use in CNC machining. To create the custom tool properly several values must be known: (1) the rotary tool style, (2) the diameter and over-all length, (3)

20   the length of cut, (4) an end style, (5) a coating type, and (6) whether there is a flat or reduced cutting diameter and/or an added neck for clearance.

        Heretofore a custom tool designing and ordering process typically required an average of two

25   to three days. The process involved a chain of information between a client or customer, an outside distributor or salesperson to an inside distributor or salesperson and then to a tool manufacturer. This

process would then proceed back and forth through the chain.

It is an objective of the disclosed invention to have the custom tool design and order process occur on-line, in real-time, with the added benefit of a final specification or print of the tool being generated to the customer-defined specifications. Thus, the custom tool designing and ordering process that historically required several days to complete can now be accomplished in a few minutes on-line, without the need for the aforementioned chain and with a reduced number of personnel.

SUMMARY OF THE DISCLOSURE

A product design apparatus and method according to the invention has a product database server operable to provide a plurality of product styles, a plurality of customizable attributes, and a plurality of composite images. There is at least one customer or client computer capable of accessing the product server and selecting the product styles and the customizable attributes based upon choices presented by the product database server and decisions made via the client computer. The product design server is operable to provide a custom product design by combining a selected product style with a plurality of selected attributes. The product database server is operable to generate graphic images of available product styles and

the customizable attributes for display on the client computer. The product database server also is operable to provide a composite image representing a combination of the representations from which the user can view a

5   finalized product.

THE DRAWINGS

These and other features and advantages of the invention are disclosed in the accompanying drawings wherein:

10   Figure 1 illustrates a topology of a global network with a product database server, a client computer, and a product manufacturer connected to the network in accordance with the preferred embodiment;

Figure 2 illustrates a web page displaying a

15   begin screen;

Figure 3 illustrates a web page displaying an information-gathering screen;

Figure 4 illustrates a web page displaying a design-system screen;

20   Figure 5 illustrates a general flow-of-control to create a cost-estimate;

Figure 6 illustrates a web page displaying a tool-style selection screen;

Figure 7 illustrates a web page displaying a

25   dimension selection screen;

Figure 8 illustrates a flow-of-control of a LOC Subroutine;

Figure 9a illustrates a web page displaying a general customization screen;

Figure 9b illustrates a web page displaying a customization screen with a text-box to input a radius-end value;

Figure 9c illustrates a flow-of-control of a Radius-Value Subroutine;

Figure 9d illustrates a web page displaying a customization screen with a text-box to input a rLOC value;

Figure 9e illustrates a flow-of-control of a Reduced-Cutting-Diameter Subroutine;

Figure 9f illustrates a web page displaying a customization screen with a text-box to input rLOC values and a text box to input neck-values;

Figure 9g illustrates a flow-of-control of a Neck-Value Subroutine;

Figure 10 illustrates a web page displaying a quantity selection screen; and

Figure 11 illustrates a web page displaying a final specification screen.

DETAILED DESCRIPTION

Apparatus and a method according to the invention are illustrated in Figure 1. The several components of apparatus are designated generally by the reference character 10 and include, in general, a product manufacturer 12 providing access to a publicly

accessible global computer network 14, such as the
Internet, having a database 16 maintained on a server
connected to the Internet. For example, a Lotus
Domino® Server can be used to provide a publicly

5   accessible web interface into the database 16. The
product database server 16 can be accessed via the
Internet from a client computer 18 anywhere in the
world, thereby enabling anyone with Internet access to
enter his own product specifications into the database

10   16.

A user begins by connecting to the apparatus
10 by utilizing an HTTP enabled browser over the global
computer network 14. Referring to Figure 2, the user
is prompted with a begin screen 20 to login as a

15   current user, or to create a user account 22. If the
user chooses to create the new user account, he will be
prompted with an information-gathering screen 30, as
shown in Figure 3, to gather a plurality of required
information about the user. The required information

20   includes an external email address 31, a system
password 32 and full name 34. The user's external
email address 31 will be the user account name that the
client will use to identify himself when accessing the
design system 10. Once the user creates an account the

25   design system 10 returns the user to the begin screen
20. If the user does not create the new user account,
the begin screen 20 is available to continue through

the design system 10. To login as a current user, the user must enter the external email address 31 in a user-account-text box 24, and the design system password 32 in a CRT-design-system-password-text box

5 26.

Once the user submits a valid user account name and design password, the design system 10 displays a screen 40 with at least two screen choices 41,42 as shown in Figure 4. A first screen choice enables

10 selections of a new cost-estimate 41 by clicking on the associated hyperlink. A second screen choice enables the selection of the ability to view a plurality of saved cost-estimates 42 by clicking on the associated hyperlink. Other sample screen choices can provide the

15 user with technical information, contact information, company information, or additional information on product quality by simply clicking on the associated hyperlinks.

In Figure 5 there are shown the data sources

20 and general flows to create a new cost estimate. Creating the new cost estimate for the design system 10 takes four steps 44, 45, 46, 47, beginning with step one 44, selecting a tool-style. As shown in Figure 6, a tool-style web page 50 contains a plurality of

25 graphical representations 52 of the product manufacturer's stock tool designs. The user selects the desired tool-style by clicking on the graphic

representation 52 or from a drop-down selection list,
generally indicated at 54. The user clicks a submit
button 56 to continue to step two and the next web page
in the design system 10. Data indicating the user

5   account name and the selected tool-style are
transmitted to the next step for additional
customization of the tool-style, using programming
techniques already known in the art.

In step two 45 as illustrated in Figure 7,

10   the user selects a dimension for the previously
designated tool-style on a dimension selection screen
60. The user selects the desired tool-style dimension
by clicking on the graphic representation or from a
drop-down dimension-selection list, generally shown at

15   62. The dimension list is static based upon the
manufacturer's capability to produce the tool. The
form of the dimension measurement is diameter (D) by
overall-length (OAL), or D x OAL. The user can select
the dimension in either fraction (English) or metric

20   dimensions.

At this stage it is possible to include a
plurality of manufacturer-defined settings that the
user may customize. One example of the manufacturer-
defined setting includes a length of cut (LOC). The

25   user enters a LOC value in a LOC text box 64. Using
programming techniques known in the art, a LOC
validation subroutine 70 validates the LOC to ensure it

is not too large for the dimension selected with data

flows illustrated in Figure 8. The LOC validation

subroutine 70 multiplies the OAL by a manufacturer-

defined LOC percentage that is preferably 55%, but can

5   be any value up to 55, but not exceeding 100. Thus, if

the LOC is greater than preferably 55% of the OAL 71,

then the LOC is too large, and the LOC subroutine

alerts the user 72 and requests the user to enter

another value for the LOC. The design system 10 also

10   restricts the value of the LOC to three decimal places

if the LOC is in English 74, or two decimal places if

the LOC is in metric 76. The LOC validation subroutine

continues to alert the user 72 until the LOC is

validated. Once the LOC validation subroutine has

15   properly validated 78 the data entered by the user, the

user then clicks a submit button 66 to proceed to step

three and the next web page in the design system 10.

Data indicating the user account name, the selected

tool style, and the customized dimensions (D, OAL, and

20   LOC) are transmitted to the next step for additional

customization of the tool style, using programming

techniques already known in the art.

Step three 46 illustrated in Figure 9a is the

additional attribute customization step. In the

25   preferred embodiment, a customization web page 80 with

step three 46 contains at least one sub-step, but

preferably three. In sub-step one of step three 46,

generally shown at 81, the user can select one of three
end styles generally shown at 82: (1) a ball-end, (2) a
square-end, and (3) a radius-end. If either the ball-
end or the square-end is selected, the design system

5   does not validate the user's choice because the ball-
end and the square-end have predefined values. However
as illustrated in Figure 9b, if the radius-end is
specified, the design system 10 displays a text box 90
to enter a radius-value. A radius-value subroutine 100

10   validates the radius-value to ensure the radius-end is
not too large with data flow illustrated in Figure 9c.
The radius-value subroutine checks if the radius end is
greater than 50% of the diameter 101, then the
subroutine determines the radius value is too large 102

15   and the user must enter a smaller value. But if the
radius end is equal to 50% of the diameter 104, then
the subroutine requests the user to select the ball end
106.

As shown in Figure 9d, sub-step 2 has

20   additional manufacturer-specific requirements,
generally shown at 84: (1) a flat 85, (2) a reduced-
cutting-diameter 86, and (3) a neck-for-clearance 87.
If the user selects to include the flat 85, the design
system 10 does no additional validation.

25   However, if the user selects to add the
reduced-cutting-diameter 86, also referred to as the
rLOC, the design system 10 presents the user with a

text box 120 to specify a rLOC value. Figure 9e

illustrates data flow for a reduced-cutting-diameter

subroutine 140 that validates the rLOC value. The

reduced-cutting-diameter subroutine checks whether rLOC

5   > D at 141, and if so the reduced-cutting-diameter

subroutine signals the rLOC value is too large 142 and

activates the alert user 143. Additionally, the

reduced-cutting-diameter subroutine checks if D = 3 or

D = 0.125 at 144, then if the rLOC value < 49% of the

10   diameter 146, the rLOC value is too small 147 and a

signal is sent to the alert user 148. Otherwise if the

rLOC value < 74% of the diameter 149, the rLOC value is

too small 150 and the alert user 143 is activated. If

the rLOC value is neither too small nor too large, the

15   reduced-cutting-diameter subroutine validates 152 the

rLOC value and stores it as one of the customizable

attributes.

If the user selects to add the neck-for-

clearance 87 as illustrated in Figure 9f, the design

20   system 10 presents the user with a text box 160 to

specify a neck-value. A neck-value subroutine 170

validates the neck-value. If the neck-value > 6 times

the diameter 171, then the neck-value is too large and

the subroutine alerts the user 172. If the LOC + the

25   neck-value > 2/3 the OAL 174, then the neck-value is

also too large and the subroutine alerts the user 172.

Otherwise, if the neck-value is not too large, the

neck-value subroutine validates 178 the neck-value and stores it as another of the customizable attributes.

Finally, in sub-step three and referring back to Figure 9a, the user can select another customizable attribute, namely, a coating type, generally shown at 82. Possible coating selections include, but are not limited to: (1) no coating, (2) TiAlN, (3) TiCN, and (4) TiN. A plurality of graphic representations 82 are presented to aid in selecting the additional customized attributes. The user selects the coating type by clicking on the graphic representation 82 or from a drop-down selection list 88. The user clicks a submit button 83 to continue to step four and the next web page in the tool design system 10. Data indicating the user account name, the selected tool-style, the customized dimensions (D, OAL, and LOC), the added flat (if selected), the rLOC value (if selected), the neck-value (if selected), and the coating type are transmitted to the next step, using programming techniques already known in the art, for additional customization of the tool-style.

In step four, the tool design system displays to the user a quantity selection screen 180, as illustrated in Figure 10 where the user inputs a plurality of quantities, generally shown at 184, to preview different price quotes based on the different quantities. Data indicating the user account name, the

selected tool-style, the customized dimensions (D, OAL, and LOC), the added flat (if selected), the rLOC (if selected), the neck-value (if selected), the coating type, and the user-selected quantities are transmitted

5   to a final specification result page, using programming techniques already known in the art. The user then finalizes the tool-style quotation to create a final specification by clicking a submit button 182 to proceed to a final specification and a next web page in

10   the tool design system 10.

As illustrated in Figure 11, a final specification web page 200 displays a graphic 202 that is a representation of the custom designed tool, as well as a plurality of numerical values 204 necessary

15   to produce the tool. A graphic tool file name for the graphic 202 is created by concatenating a plurality of codes from the data obtained from steps one through three. The typical format is: a tool-style code + a customized attribute code + image format. For example,

20   if the specification results in a tool design having five 45° flutes for stainless steel, nickel and titanium alloys, the tool-style code could be DEF2. If the tool further has a ball-end, and a reduced-cutting-diameter, the corresponding customized attribute codes

25   are B, and rD, respectively. Thus, the displayed graphic 202 would be ABC1BrD.jpeg. However, it is possible to create the finalized graphic representation

utilizing known programming techniques and object-oriented programming languages like Java®. The data from the previous three steps are also included on the final specification: the tool-style 206, the end-style 208, the coating-type 210, the dimensions 212, the LOC 214, flat (if selected), rLOC 216 (if selected), the neck-value (if selected), and the sample quantities 217.

Once created, the specification becomes associated with the user account name, and is available according to a LIFO stack of saved specifications. The user can: (1) print the specification by pressing a print button 218, (2) email the specification to the external email address 30 by pressing an email button 220, (3) create a new quote, thereby returning to step one 44, by pressing a new-create new-quote button 222, or (4) order the rotary tool based upon the final specification with the prices shown for the desired quantities by pressing an order-now button 224.

The disclosure is representative of the presently preferred apparatus and methods, but is intended to be illustrative rather than definitive thereof. The invention is defined in the claims.